U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Gardenia remyi*

COMMON NAME: Nanu

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: April 2010

STATUS/ACTION

___ Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status
___ New candidate
_X__ Continuing candidate
___ Non-petitioned
_X__ Petitioned - Date petition received: May 11, 2004
__ 90-day positive - FR date:
_X_ 12-month warranted but precluded - FR date: May 11, 2005
_N_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES
a. Is listing warranted (if yes, see summary of threats below)? Yes
b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes
c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded.
Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (*http://endangered.fws.gov/*) provides information on listing actions taken during the last 12 months.

_N_ Listing priority change
Former LP: ___
New LP: ___
Date when the species first became a Candidate (as currently defined): October 25, 1999

___ Candidate removal: Former LP: ___
___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
___ F – Range is no longer a U.S. territory.
___ I – Insufficient information exists on biological vulnerability and threats to support listing.
___ M – Taxon mistakenly included in past notice of review.
___ N – Taxon does not meet the Act's definition of "species."
___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Rubiaceae (Coffee family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Kauai, Molokai, Maui, and Hawaii

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands Kauai, Molokai, Maui, and Hawaii

LAND OWNERSHIP: Approximately one-half of the populations occur on State lands, and one-half are on private lands. One individual occurs on Federal land.

LEAD REGION CONTACT: Linda Belluomini, (503) 231- 6283, linda_belluomini @fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, (808) 792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION

Species Description
Gardenia remyi is a tree 10 to 43 feet (ft) (3 to 13 meters (m)) tall with branches that are quadrangular, puberulent and viscid. Leaves are few, clustered towards the tips of the branches, elliptic to broadly elliptic or obovate, 3.5 to 9.5 inches (in) (9 to 24 centimeters (cm)) long, 2 to 4 in (5 to 10 cm) wide, with the upper surface glabrous and the lower surface dull. Flowers are fragrant, solitary, and terminal, with a narrowly funnelform hypanthium and a white corolla that is six to eight-lobed. Fruit are orange, subglobose to broadly ellipsoid, and 0.4 to 1 in (1 to 2.8 cm) in diameter. Seeds are irregularly obovate, 0.07 to 0.08 in (1.8 to 2.1 millimeters) long (Wagner *et al.* 1999, p. 1,133).

Taxonomy
Gardenia remyi was described by H. Mann (1867). This species is recognized as a distinct taxon in the *Manual of Flowering Plants of Hawaii* (Wagner *et al*. 1999, p. 1,133), the most recently accepted Hawaiian plant taxonomy.

Habitat/Life History
Typical habitat is mesic to sometimes wet forest at elevations between 197 and 2,493 ft (60 to 760 m) (Wagner *et al.* 1999, p. 1,133).

Historical Range

Historically, this species was found on the island of Hawaii at Wao Kele O Puna Natural Area Reserve, Waiakea Forest Reserve (FR), Pahoa, and Hakalau Nui. On Kauai, this species ranged across the island from Halelea, Kealia, Moloaa, and Lihue-Koloa FRs, including Hanakapiai Valley, Mahaulepu, and East Wahiawa Bog. On Maui, this species was known from Wailuaiki and Waikamoi in the Koolau FR, and from Papaaea and Kipahulu. On Molokai, this species was known from Keopukaloa, Pukoo, Honomuni, Halawa, and Kaluaaha (Hawaii Biodiversity and Mapping Program (HBMP) 2008).

Current Range/Distribution

Currently, this species is found from northeastern Kohala south to Hawaii Volcanoes National Park on the island of Hawaii; from northern and southern Kauai; from the east and west Maui mountains; and from Pelekunu Preserve, the Molokai FR, and private property on the southeastern side of Molokai (HBMP 2008).

Population Estimates/Status

Gardenia remyi is known from 19 populations totaling between 85 and 87 individuals on the islands of Kauai, Molokai, Maui, and Hawaii (HBMP 2008; K. Wood, National Tropical Botanical Garden (NTBG), pers. comm. 2005; H. Oppenheimer, Plant Extinction Prevention Program (PEP), pers. comm. 2006; L. Perry, Division of Forestry and Wildlife (DOFAW), pers. comm. 2006; P. Welton, National Park Service (NPS), pers. comm. 2008; N. Agorastos, DOFAW, pers. comm. 2010; S. Perlman, NTBG, pers. comm. 2010). On Kauai, populations are at Limahuli (6 individuals), Kalalau (below Pihea, 10 individuals, east Kalalau (4 individuals), at Puuauuka (1 individual), at Puu Kolo (2 individuals), at Waioli Valley (1 individual), Mount Kahili (1 individual), and at Waipa (6 individuals) (National Tropical Botanical Garden 2008; S. Perlman, pers. comm. 2010). The population in the Molokai FR has been observed to decline from approximately 20 individuals to 4 individuals over the past 5 years (H. Oppenheimer, pers. comm. 2006). Also on Molokai, there is 1 individual at Manuahi ridge, and possibly one individual remains at Mapulehu. On east Maui there is 1 individual at Kipahulu, and on west Maui there are 2 individuals at Honokohau drainage, a small population at Honolua peak (21 individuals), and 9 individuals at Honokohau-Hononana ridge (H. Oppenheimer, pers. comm. 2006; P. Welton, pers. comm. 2009). Several individuals were recently found on the island of Hawaii, 1 in the Waiakea FR, 1 in Wao Kele o Puna, and 6 to 12 from Honopue to Waipio (L. Perry, pers. comm. 2006; L. Pratt, U.S. Geological Survey-Biological Resources Discipline (USGS-BRD), pers. comm. 2008; P. Welton, pers. comm. 2009; J. Giffin, The Nature Conservancy (TNC), pers. comm. 2009).

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range. This species is threatened by feral pigs (*Sus scrofa*), goats (*Capra hircus*), and deer (*Axis axis*) that degrade and destroy habitat (PEP 2008, p. 102; HBMP 2008; L. Perry, pers. comm. 2006). Pigs are a threat to *Gardenia remyi* populations in the Kohala mountains and at Wao Kele O Puna on the island of Hawaii; the Halelea and Lihue-Koloa FRs on Kauai; the West Maui FR and Natural Area Reserve, and the Puu Kukui Preserve on Maui; and at the Molokai FR population. Goats are a threat to *G. remyi* on the island of Molokai at the Pelekunu Preserve and

Molokai FR populations. Axis deer are reported to be a threat to the Molokai FR population (HBMP 2008).

Pigs of Asian ancestry were introduced to Hawaii by the Polynesians, and the Eurasian type was introduced to Hawaii by Cook in 1778, with many other introductions thereafter (Tomich 1986, p. 121). Some pigs raised as food escaped into the forests of Hawaii, Kauai, Oahu, Molokai, Maui, and Niihau, formed herds, and are now managed as a game animal by the State to optimize hunting opportunities (Tomich 1986, p. 125; State of Hawaii 2001). A study was conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui (Diong 1982, 408 pp.). This valley consists of a diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, *Acacia koa* (koa) to *Metrosideros polymorpha* (ohia). Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 in (20 cm), greatly disrupting the leaf litter and topsoil layers, contributing to erosion and changes in ground topography (Diong 1982, pp. 143-150). The feeding habits of pigs created seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava) (Diong 1982, pp. 164-165). The study concluded that all aspects of the food habits of pigs are damaging to the structure and function of the Hawaiian forest ecosystem (Diong 1982, pp. 166-167). The effects on mesic and wet forest habitat by foraging of feral pigs have also been reported in fencing studies. In a fencing study conducted in the montane bogs of Haleakala, it was found that when feral pigs were fenced out of an area the cover of native plant species increased from 6 percent to 95 percent within six years of protection (Loope *et al*. 1991, pp. i, 13).

The goat, a species originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. Currently, populations exist on Kauai, Oahu, Maui, Molokai, and Hawaii. Feral goats eat native vegetation, trample roots and seedlings, cause erosion, and promote the invasion of alien plants. They are able to forage in extremely rugged terrain and have a high reproductive capacity (Clarke and Cuddihy 1980, p. C20; van Riper and van Riper 1982, pp. 34-35; Scott *et al*. 1986, pp. 352-358; Tomich 1986, pp. 150-156; Culliney 1988, pp. 336-337; Cuddihy and Stone 1990, p. 64). *Gardenia remyi* is vulnerable to the long-term, indirect effects of goats, such as large-scale erosion.

Axis deer were introduced to Molokai in 1868, and within 30 years the population was estimated to be 7,000 animals. By 1996, the deer population at Kalaupapa had resulted in remarkable negative impacts on the vegetation (Dorman 1996). Axis deer eat native vegetation, trample roots and seedlings, cause erosion, and promote the invasion of alien plants, and can jump fences constructed for feral pig control. The interaction of feral pigs and axis deer has reduced the *Metrosideros-Cibotium* (ohia-hapuu) rain forest to a grassy scrubland (Dorman 1996). Axis deer have moved from their preferred habitat in relatively open, lower elevation shrub areas, into the rain forest above Halawa Valley, likely due to hunting pressure (Dorman 1996). Currently, the axis deer population is estimated to be at least 1,500 on Molokai ranch lands alone, and 5,000 to 6,000 animals for Molokai and Lanai combined (Dorman 1996; P. Nicholas, Molokai Ranch, *in litt*. 2006).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by pigs, goats, deer, and other introduced ungulates (Loope *et al*. 1991, p. 3).

Because of demonstrated habitat modifications by feral pigs, goats, and deer, such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants, the U.S. Fish and Wildlife Service (Service) believes they are a threat to *Gardenia remyi*.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
Predation by feral pigs, goats, and deer is a likely threat to *Gardenia remyi*, as they browse on leaves and other parts of any woody or fleshy plant species.

In a study conducted in the 1980s, pigs were observed browsing on young shoots, leaves, and fronds of a wide variety of plants, of which over 85 percent were endemic species (Diong 1982, p. 138). A stomach content analysis in this study showed that the pigs' food sources consisted of native plants, 60 percent of which were *Cibotium* spp. (tree ferns), alternating with *Psidium cattleianum* (strawberry guava) when it was available. Pigs were observed to fell plants and remove the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species, with larger trees killed over a few months of repeated feeding (Diong 1982, pp. 138, 144).

Goats browse on introduced grasses and native plants, and are able to reach more remote and inaccessible areas than other ungulates. They thrive on a variety of food plants, and are instrumental in the decline of native vegetation in many areas in Hawaii (Cuddihy and Stone 1990, p. 64).

Deer are primarily grazers, but also browse numerous plant species (Waring 1996).

Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Merlin and Juvik, p. 597). Therefore, even though there are no observations of direct browsing on *Gardenia remyi*, it is likely that pigs, goats, and deer impact this species directly.

D. The inadequacy of existing regulatory mechanisms.
Gardenia remyi currently receives no protection under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Pigs, goats, and deer are managed in Hawaii as game animals, but many populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990, p. 3). Pig, goat, and deer hunting is allowed on all islands either year-round or during certain months, depending on the area; however, public hunting does not adequately control the number of ungulates to eliminate this threat to native plant species (Hawaii Department of Land and Natural Resources 1999, 2003).

E. Other natural or manmade factors affecting its continued existence.
Alien plant species threaten *Gardenia remyi* as they degrade habitat and outcompete native

plants (H. Oppenheimer, pers. comm. 2006; L. Perry, pers. comm. 2006; P. Welton, pers. comm. 2008).

The nonnative plants that are reported to be the greatest threats to the Hawaii Island populations of *Gardenia remyi* are: *Clidemia hirta* (koster's curse), *Psidium cattleianum* (strawberry guava), *Tibouchina herbacea* (glorybush), *Hedychium flavescens* (yellow ginger), *H. gardnerianum* (kahili ginger), *Sphaeropteris cooperi* (Australian tree fern), *Melastoma candidum* (NCN), and *Setaria palmifolia* (palmgrass) (HBMP 2008; L. Perry, pers. comm. 2006; P. Welton, pers. comm. 2008; PEP 2008, p. 102). The nonnative plants that currently pose the greatest threat to the Kauai populations are: *Clidemia hirta*, *Rubus rosifolius* (thimbleberry), *Lantana camara* (lantana), and *Paspalum conjugatum* (Hilo grass) (HBMP 2008). The nonnative plants that currently pose the greatest threat to the Maui populations include *Tibouchina herbacea*, *Clidemia hirta*, *Ageratina adenophora* (Maui pamakani), and *Rubus rosifolius* (HBMP 2008). The nonnative plants that currently pose the greatest threat to the Molokai populations are *Clidemia hirta* and *Psidium cattleianum* (HBMP 2008).

Ageratina adenophora is native to tropical America and has naturalized in dry to wet forest on the islands of Oahu, Molokai, Lanai, and Maui (Wagner *et al*. 1999, pp. 254-255). Maui pamakani is a shrub 3 to 5 ft (1 to 1.5 m) tall with trailing branches that root on contact with soil. It forms dense mats which prevent regeneration of native plants (Anderson *et al*. 1992, p. 315; University of California 2006). It is considered a serious weed in agriculture, especially in rangeland, because it often replaces more desirable vegetation or native species and is fatally toxic to horses and most livestock. The eupatorium gall fly, *Procecidochares utilis*, was introduced to Hawaii in 1944 for control of Maui pamakani, and has been successful in suppression of most of the infestations (Bess and Haramoto 1959, p. 248).

Clidemia hirta is a noxious shrub first cultivated on Oahu prior to 1941. This pest plant forms a dense understory, shading out native plants and hindering their regeneration, and is considered a serious plant threat (Wagner *et al*. 1985, p. 41; Smith 1989, p. 189). The most promising biological control to date for Koster's curse is the *Colleotrichum* fungus, *Gloesporioides* f. sp. *clidemiae*, released in 1986. Although there is no quantitative data available, the fungus has an observable negative impact. Other agents tested were a moth (*Antiblemma acclinalis*), a leaf-feeding beetle (*Lius poseidon*), a fruit and flower-feeding insect *(Mompha trithalama)*, and a terminal growth-feeding insect (*Liothrips urichi*), all with lesser control success than the fungus (Smith 1989, p. 189).

Hedychium flavescens, a perennial herb up to 6.6 ft (2 m) tall, native to northeastern India and the Himalayas, is cultivated as an ornamental plant and is naturalized in Hawaii (Wagner *et al.* 1999, pp. 1,622-1,623). Yellow ginger forms dense colonies, crowding out all other plants, and reproduces by rhizomes (PIER 2009a).

Hedychium gardnerianum is native to India (Nagata 1999, p. 1,623). This showy ginger was introduced for ornamental purposes, and was first collected in 1954 at Hawaii Volcanoes National Park (Wester 1992, p. 124). Kahili ginger grows over 3 ft (1 m) tall in open light environments, preferring a warm moist climate; however, it will readily grow in full shade beneath a forest canopy. It forms vast, dense colonies, displacing other plant species, and

reproduces by rhizomes. The conspicuous, fleshy, red seeds are dispersed by fruit-eating birds as well as by man (Pacific Islands Ecosystems at Risk (PIER) 2006b). Aircraft-based analysis has shown that ginger reduces the amount of nitrogen in the *Metrosideros* forest canopy in Hawaii, a finding later corroborated by ground-based sampling (Asner and Vitousek 2005). This species may also block stream edges, altering water flow (Global Invasive Species 2006a). Kahili ginger can be controlled by herbicides, but biological control is considered the only practical approach for the long-term management of large infestations in native forests. The ability of the bacterium *Ralstonia* (=*Pseudomonas*) *solanacearum* to cause bacterial wilt in kahili ginger in the field, together with its lack of virulence in other ginger species, contributes to its potential as a biological control agent (Anderson and Gardner 1999, p. 95; Anderson 2003).

Lantana camara, brought to Hawaii as an ornamental plant, is an aggressive, thicket-forming shrub which is now found on all of the main islands in mesic forest, dry shrubland, and other disturbed habitats (Wagner *et al*. 1999, p. 1,320). The most effective control agents are the lace bug *Teleonemia scrupulosa* Stal. (Tingidae); the chrysomelid beetles *Octotoma scabripennis* Guerin-Meneville and *Uroplata girardi* Pic; and the moths *Hypena strigata* F. and *Neogalea sunia* (Guenee) (Noctuidae), and *Salbia haemorrhoidalis* Guenee (Pyralidae). While biological control of lantana by most of the established insects appeared to have reached equilibrium by 1969, the overall impact of the phytophage complex has been a steady and considerable reduction in abundance of the weed, particularly in drought-prone areas. Although lantana is considered generally to be under partial to substantial control in drier areas, it still remains a pest in some other environments, such as national parks (Hawaii Department of Agriculture 2006).

Melastoma candidum (now *M. septemnervium*) is a shrub or small tree up to 16 ft (5 m) tall, native to southeast Asia and southern Japan. It is naturalized in Hawaii in mesic to wet areas, where it is abundant and invasive (Wagner *et al*. 1999, pp. 910-911). This shrub forms tangled brush which crowds out all other species (Smith 1985, p. 194). The fruit are dispersed by frugivorous birds (Smith 1985, p. 194).

Paspalum conjugatum is a grass native to the Neotropics, and was introduced for cattle fodder and quickly spread (Cuddihy and Stone 1990, pp. 82-83). It is naturalized in moist to wet disturbed sites along roadsides and in open fields (O'Connor 1999, p. 1,576). It forms a dense ground cover even on acidic, low-nutrient soils (PIER 2006c). Its small hairy seeds are easily transported on humans and animals or are carried by the wind through native forests. No biological control agents have been tested for this species (University of Hawaii 2006).

Psidium cattleianum, a tree native to tropical America, is widely naturalized on all the main islands of Hawaii. Found in mesic to wet forests, strawberry guava develops into dense stands in which few other plants can grow, displacing native vegetation. The fruit is eaten by pigs and birds, which then disperse the seeds throughout the forest (Smith 1985, p. 200; Wagner *et al*. 1999, p. 971). A biological control agent, *Tectococus ovatus*, has undergone 15 years of testing, and there is a proposal to release this insect at Olaa Forest Reserve (ScienceDaily 2008).

Rubus rosifolius is native to Asia and is common in Hawaii in disturbed mesic to wet forest on all of the main islands. It is a sparse shrub, covered with prickles, and has edible red fruit. It invades the understory, forming dense thickets and outcompetes native plant species. It easily

reproduces from roots left in the ground, and seeds are spread by feral animals and birds. There is no specific management information for *R. rosifolius*, but techniques used for the control of *R. fruticosus* (blackberry), a related species, may be applicable (PIER 2006d; Global Invasive Species 2006b).

Setaria palmifolia is native to tropical Asia, and was first collected on Hawaii Island in 1903 (O'Connor 1999, pp. 1,592-1,593). A large-leafed perennial herb, this species attains about 6.5 ft (2 m) in height at maturity, shading out native vegetation. Palmgrass is resistant to fire and recovers quickly after being burned. Feral animals provide new areas for establishment by disturbing and opening areas in native vegetation (Cuddihy and Stone 1990, pp. 82-83). Chemical control methods are used currently, and no known biocontrol research is being conducted for this species (Motooka *et al*. 2003).

Sphaeropteris cooperi, a tree fern native to Australia, is used in landscaping in Hawaii because it is faster growing and more tolerant of warmer, drier conditions than the native Hawaiian tree ferns, and has escaped from cultivation (Medeiros *et al*. 1992, pp. 30-31). It can achieve high densities in native Hawaiian forest, grows up to 1 ft (0.3 m) in height per year, with maximum known heights of 39 ft (12 m) (Jones and Clemesha 1981, pp. 56-57), and can displace native species. Understory disturbance by pigs facilitates the establishment of *S. cooperi* (Medeiros *et al*. 1992, pp. 30-32). This species has been known to spread over seven miles (12 kilometers) by windblown dispersal of spores from plant nurseries (Medeiros *et al*. 1992, pp. 28-31; Palmer 2003, p. 245).

Tibouchina herbacea, a member of the Melstomataceae family, is native to southern Brazil, Uruguay, and Paraguay. In Hawaii, it is naturalized and abundant in disturbed mesic to wet forest on the islands of Hawaii, Maui, and Lanai (Wagner *et al*. 1999, p. 915). All members of this genus are legally declared noxious in the state of Hawaii (Hawaii Administrative Rules (HAR) Title 4, Subtitle 6, Chapter 68). Research is ongoing for biological controls of this species (Smith 1998; The Nature Conservancy 2003, p. 8).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the current total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent are introduced species, and nearly 100 species are pests (Smith 1985, p. 180; Wagner *et al*. 1999, p. 45). Confirmed personal observations (H. Oppenheimer, pers. comm. 2006; L. Perry, pers. comm. 2006; P. Welton, pers. comm. 2008) and several studies (Cuddihy and Stone 1990, p. 74; Robichaux *et al*. 1998, p.4) indicate nonnative plant species may outcompete native plants similar to *Gardenia remyi*. Competition may be for space, light, water, or nutrients, or there may be a chemical produced that inhibits growth of other plants (Smith 1985, pp. 227-230; Cuddihy and Stone 1990, p. 74). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smith 1985, pp. 240-241; Loope and Medeiros 1992, pp. 7-8; Medeiros *et al*. 1992, p. 30; Ellshoff *et al*. 1995, pp. ii, 3-4; Meyer and Florence 1996, p. 778; Medeiros *et al*. 1997, pp. 23-24, Loope *et al*. 2004, p. 1,472). In particular, alien pest plant species degrade habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985, pp. 227-230; Cuddihy and Stone 1990, p. 74; Vitousek *et al*. 1997, pp. 6-10). Because of demonstrated habitat modification and

resource competition by nonnative plant species in habitat similar to the mesic to wet forest habitat of *G. remyi*, the Service believes nonnative plant species are a threat to *G. remyi*.

Landslides are a threat to the population of *Gardenia remyi* ranging from Honopue to Waipio in the Kohala mountains on Hawaii Island (L. Perry, pers. comm. 2006).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

Maui Land and Pineapple Company manages the Puu Kukui Preserve area on Maui, including fencing and controlling nonnative plants in the preserve. The West Maui Mountain Watershed Partnership, a non-governmental, non-profit partnership composed of West Maui landowners and managers, received funding from the Service from 2000 to 2004 for construction of ungulate exclosure fences, including the Kahakuloa Game Management Area, and for ungulate and nonnative plant control (Maui Land and Pineapple Company 1999). The partnership has completed construction of the fences. These actions are expected to benefit individuals of *Gardenia remyi* that occur in the west Maui mountain area.

This species is represented in ex situ collections at the Volcano Rare Plant Facility, NTBG, and at Lyon Arboretum (Service 2005; N. Sugii, Lyon Arboretum, pers. comm. 2006; Volcano Rare Plant Facility 2008; NTBG 2008, p. 6).

SUMMARY OF THREATS

Based on our evaluation of habitat degradation and loss by feral pigs, goats, deer, and nonnative plants, we conclude there is sufficient information to develop a proposed listing rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of individuals of *Gardenia remyi* due to competition with nonnative plants for space, nutrients, water, air, and light. Predation by feral pigs, goats, and deer is a likely threat to *G. remyi*. Landslides are a likely threat to one population on Hawaii Island. We find that this species is warranted for listing throughout all of its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES

- Survey for populations of *Gardenia remyi* in areas of potentially suitable habitat
- Control feral ungulates
- Control alien plants
- Continue propagation efforts for maintenance of genetic stock
- Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:
This species is highly threatened by pigs, goats, and deer that degrade and destroy habitat, and by nonnative plants that outcompete and displace it. Predation by pigs, goats, and deer are also likely threats. These threats to the mesic and wet forest habitat of *Gardenia remyi*, and to individuals of this species, occur throughout its range and are expected to continue or increase without their control or eradication. Feral pigs have been fenced out of the west Maui populations of *G. remyi*, but the fences must be continually maintained to prevent incursion. Nonnative plant numbers have been reduced in the populations that are fenced. This species is represented in ex situ collections. Ongoing conservation efforts for this species benefit only the west Maui populations. The remaining populations of this species are still impacted by these threats and will require long-term monitoring and management to maintain threat free areas.

Imminence:
Threats to *Gardenia remyi* from pigs, goats, deer, and nonnative plants are imminent because they are ongoing in the unfenced populations.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, the Service has funded conservation actions that will benefit *Gardenia remyi*, including

ungulate exclosures and ungulate and nonnative plant control in the west Maui mountains; and fencing in the Kahakuloa Game Management Area. If it becomes apparent that the routine listing process is not sufficient to prevent further losses that may result in this subspecies' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *G. remyi* new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING

The information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December 1995. We incorporated additional new information on this species from information in our files and from the *Manual of the Flowering Plants of Hawaii* (Wagner *et al*. 1999). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii DOFAW; Joel Lau, Hawaii Natural Heritage Program; Arthur Medeiros, USGS-BRD; Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, NTBG. New information on status and range was provided by Hank Oppenheimer. In 2005 we contacted species experts and confirmation of the status of *Gardenia remyi* was provided by Hank Oppenheimer of the Maui Land and Pineapple Company, and by Ken Wood of the NTBG. In 2006 new status and range information was provided by Hank Oppenheimer, PEP; Lyman Perry, Hawaii DOFAW; and Nellie Sugii, Lyon Arboretum. In 2008 we received new information from Linda Pratt (USGS-BRD) and Patti Welton (NPS) regarding the status of *Gardenia remyi* on Hawaii and Maui. In 2009, we received new information from Jon Giffin (TNC) and Patti Welton (NPS). In 2010, we received new information from Nick Agorastos (DOFAW) and Steve Perlman (NTBG).

List all experts contacted:

Name	Date	Affiliation
Agorastos, Nick	02/09/10	Hawaii Division of Forestry and Wildlife
Anderson, Stephen	02/09/10	National Park Service, Haleakala NP, Maui
Aruch, Sam	02/09/10	Private contractor
Bakutis, Ane	02/09/10	Plant Extinction Prevention Program, Molokai
Ball, Donna	02/09/10	U.S. FWS, Partners Program, Hawaii Island
Beavers, Sally	02/09/10	National Park Service, Hawaii Island
Bily, Pat	02/09/10	The Nature Conservancy, Maui
Bio, Kealii	02/09/10	Plant Extinction Prevention Program, Hawaii Island
Brosius, Chris	02/09/10	West Maui Mountains Watershed Partnership
Caraway, Vickie	02/09/10	Hawaii Division of Forestry and Wildlife, Oahu
Ching, Susan	02/09/10	Plant Extinction Prevention Program, Oahu
Cole, Colleen	02/09/10	Three Mountain Alliance
Conry, Paul	02/09/10	Hawaii Division of Forestry and Wildlife
Coordinator	02/09/10	East Maui Watershed Partnership
Duvall, Fern	02/09/10	Hawaii Division of Forestry and Wildlife, Maui
Fay, Kerri	02/09/10	The Nature Conservancy, Maui
Garnett, Bill	02/09/10	National Park Service, Kalaupapa, Molokai

Giffin, Jon	02/09/10	The Nature Conservancy, Hawaii Island
Haus, Bill	02/09/10	National Park Service, Haleakala NP, Maui
Higashino, Jennifer	02/09/10	U.S. Fish and Wildlife Service, Maui
Imada, Clyde	02/09/10	Bishop Museum
Jacobi, Jim	02/09/10	U.S.G.S.- Biological Resources Discipline
Kawakami, Galen	02/09/10	Hawaii Division of Forestry and Wildlife, Kauai
Kawelo, Kapua	02/09/10	U.S. Army, Environmental Division
Kier, Matt	02/09/10	U.S. Army, Environmental Division
Kiyabu, Brian	02/09/10	Amy Greenwell Botanical Garden
Kraus, Jim	02/09/10	U.S. Fish and Wildlife Service, Hakalau NWR
Medeiros, Arthur	02/09/10	U.S.G.S.-Biological Resources Discipline
Misaki, Ed	02/09/10	The Nature Conservancy, Molokai
Moriyasu, Patty	02/09/10	Volcano Rare Plant Facility, Hawaii Island
Moses, Wailana	02/09/10	The Nature Conservancy, Molokai
Nakai, Glynnis	02/09/10	U.S. Fish and Wildlife Service Maui Refuges, Maui
Oppenheimer, Hank	02/09/10	Plant Extinction Prevention Program, Maui Nui
Palomino, Anna	02/09/10	Olinda Rare Plant Nursery, Maui
Palumbo, David	02/09/10	National Park Service, Haleakala NP, Maui
Pepi, Vanessa	02/09/10	U.S. Navy, Environmental Contractor
Perlman, Steve	02/09/10	National Tropical Botanical Garden
Perry, Lyman	02/09/10	Hawaii Division of Forestry and Wildlife, Hawaii Island
Plunkett, Bryan	02/09/10	Lanai Forest and Watershed Partnership
Pratt, Linda	02/09/10	U.S.G.S.- Biological Resources Discipline
Purell, Melora	02/09/10	Kohala Watershed Partnership
Seidman, Stephanie	02/09/10	Maui Nui Botanical Garden
Shishido, Glenn	02/09/10	Hawaii Division of Forestry and Wildlife, Maui
Silbernagle, Mike	02/09/10	U.S. Fish and Wildlife Service, Oahu NWR Complex
Smith, Miranda	02/09/10	Koolau Mountains Watershed Partnership
Starr, Forest	02/09/10	U.S. Geological Survey
Tanaka, Daniel	02/09/10	Puu Kukui Watershed Preserve
Ward, Joe	02/09/10	Puu Kukui Watershed Preserve
Welton, Patti	02/09/10	National Park Service, Haleakala NP, Maui
Wood, Ken	02/09/10	National Tropical Botanical Garden
Wysong, Michael	02/09/10	Hawaii Natural Area Reserve System, Kauai

The Hawaii Biodiversity and Mapping Program identified this species as critically imperiled (HBMP 2006). Based on the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species, this subspecies is recognized as Vulnerable (facing a high risk of extinction in the wild) (Bruegmann and Caraway 2003). *Gardenia remyi* is not included in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell *et al*. 2005).

COORDINATION WITH STATES

On February 11, 2010, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. We received new

information from Nick Agorastos.

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:

Acting Carolyn A. Bohan 5/18/10
Regional Director, Region 1, Fish and Wildlife Service Date

Lowell W Hould
ACTING
Director, Fish and Wildlife Service October 22, 2010

Concur:

Do not concur: _____ Date: _____
Director, Fish and Wildlife Service

Director's Remarks:

Date of annual review: Date: April 12, 2010
Conducted by: Cheryl Phillipson, Pacific Islands FWO
Biologist, Prelisting and Listing Program

Comments:

PIFWO Review

Reviewed by: Christa Russell Date: April 22, 2010
Prelisting and Listing Program Coordinator

Marilet Zablan Date: April 26, 2010
Assistant Field Supervisor, Endangered Species

Gina Shultz Date: April 30, 2010
Acting Field Supervisor